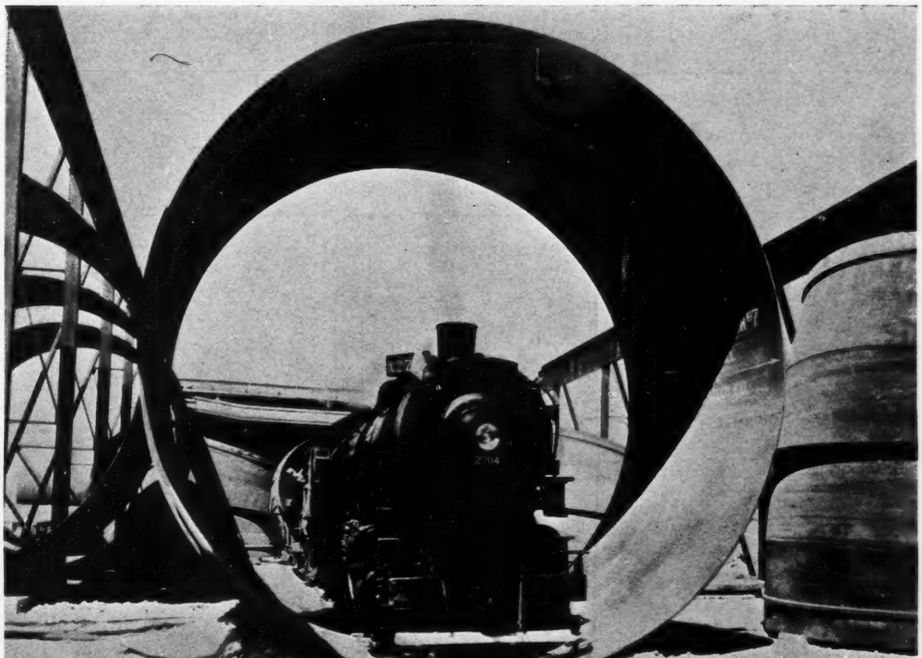
The CORNELL ENGINEER



Volume 1 NOVEMBER, 1935 Number 2

In this issue: MERCURY BOILERS *by* O. L. Wood, Jr.

POWER TRANSMISSION NEWS

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Morse Roller Chain used on Conveyor

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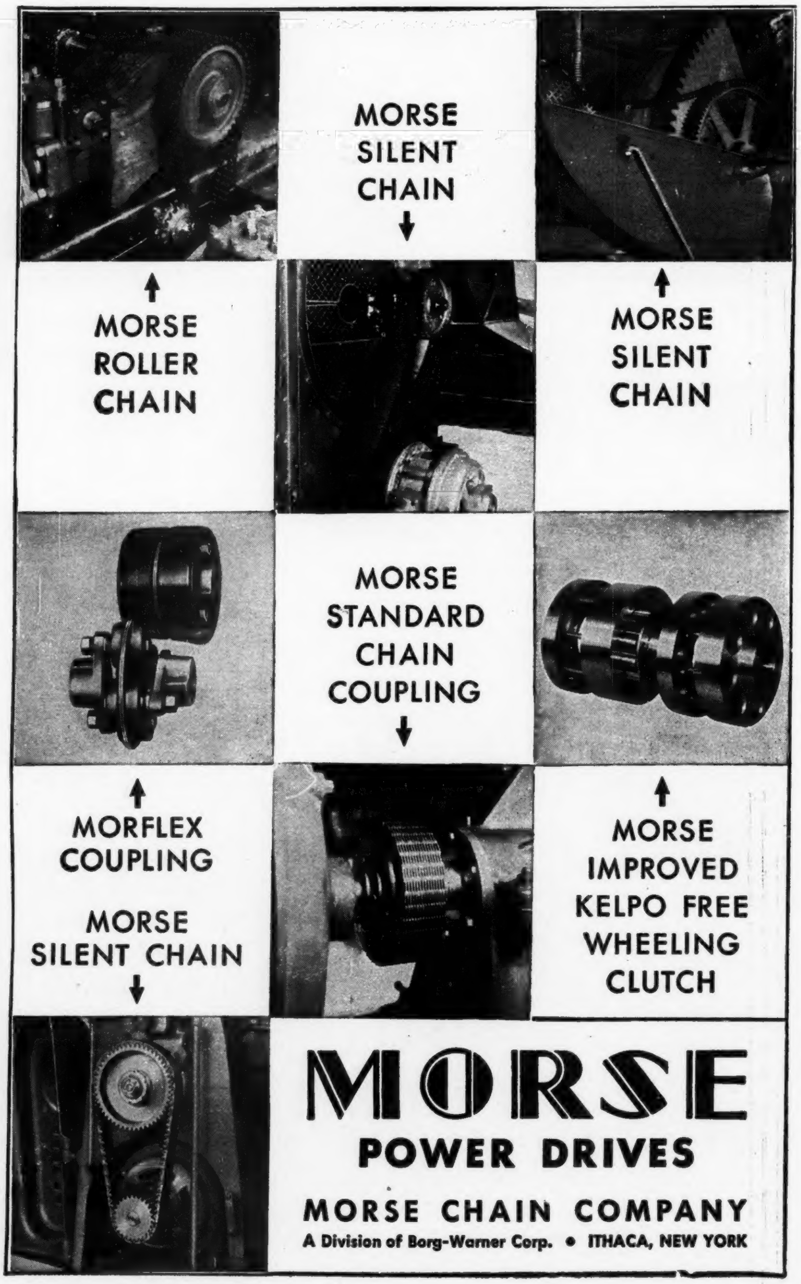

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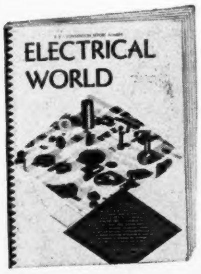

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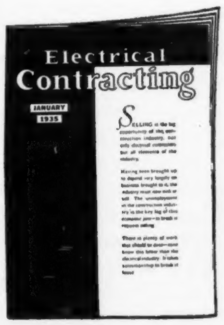

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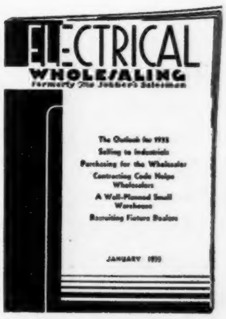

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THE CORNELL ENGINEER

Volume I | NOVEMBER, 1935 | Number 2

COMMENT

Mr. Lane discusses the theory and application of a new development in the heat-power field that should be of interest to all engineers.

* * *

In "The Science and Art of Living," "Kary" reveals the deep insight into human nature that has endeared him to hundreds of Cornell students.

* * *

George Kaye, the special representative of the ENGINEER, gives his impressions of the annual Summer Survey at Cayuta Lake.

* * *

The Society's page is of especial interest this month, since among other features the new officers for the coming year are announced.

* * *

In this issue we have hit upon the happy combination of articles by an alumnus, a faculty member, and a student; representing ME, EE, and CE.

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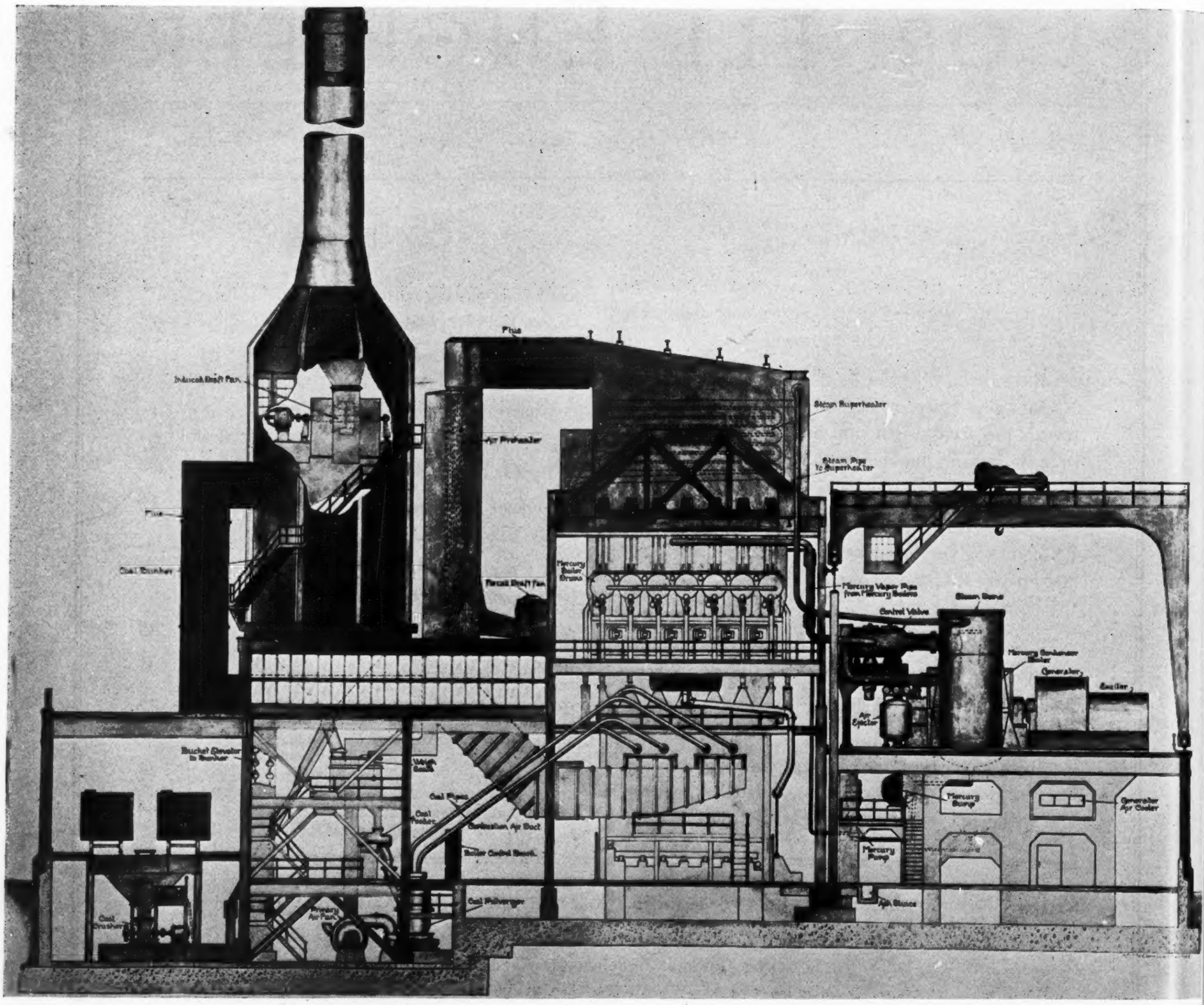


Courtesy Gen. Ele

CROSS-SECTIONAL VIEW OF MERCURY-STEAM-ELECTRIC PLANT

THE CORNELL ENGINEER

Vol. I | November, 1935 | No. 2

Mercury Boilers

By O. L. Wood, Jr. '23

Turbine Engineering Dept., General Electric Co.

When one speaks of a mercury boiler, immediately a question is raised, at least in the majority of cases. Such questions as, "What is it?", "Does it actually burn mercury?", give positive indications that the public's knowledge of this new development is quite vague. The following short description is made with the hope that it may correct this condition as well as to inform the engineer and the layman with the reason for such a boiler and its various applications.

In brief, the method of operation may be described as follows: Pure mercury is vaporized in a separate and suitable boiler heated by fuel in a manner similar to that in steam boilers. The vapor, having a lower pressure than steam, but a much higher saturated temperature, passes from the boiler through piping and valves to a turbine, which is of a relatively simple type. The available energy liberated by the vapor in passing through the turbine produces a large amount of electrical energy. On exhausting from the turbine into a condenser at a good vacuum, there is still sufficient temperature and heat left to boil the condensing water and form steam. The condenser thereby becomes, in addition, a steam boiler. The condensed mercury returns to its boiler as liquid. The steam formed in the condenser-boiler at normal power station pressures and temperatures is used in a separate steam turbine to also produce electrical energy. The exhaust steam is finally condensed in a steam condenser by giving its heat up to river or lake circulating water. There are, therefore, two turbines producing electrical energy from only one fire burning under the mercury boiler. The gain in efficiency of such a binary cycle is obvious as the laws of thermo-dynamics state that the efficiency of any heat engine is primarily dependent upon the temperature difference between the operating limits of the engine.

Now let us consider separtely the two words, Mercury Boiler. By doing this, it will divide our subject naturally into the medium that is used and the reason for using it, as well as the boiler it is used in, with its design and operating cycle.

Characteristics of Mercury

Mercury is the only metal which is a fluid at ordinary temperatures. It will solidify at 38.°F. At 32.°F. its specific gravity is 13.61, or approximately 80% heavier than steel. No matter to what temperature it is heated, or to what pressure it is subjected, it will still remain in its elementary state, provided it is in a sealed container. As yet no other substance having a higher boiling point than water with thermo-dynamic characteristics suitable for use in a binary-fluid cycle has been found to meet this test withou tattacking the container or decomposing at the high temperatures.

Being a liquid, mercury will vaporize similar to water. Its temperature operating range, indicated in the table, is much higher than water, while its working pressures are comparatively low. In these two fundamentals we have the principle reasons for its use. For instance, instead of boiling under atmosphere pressure as water does at 212.°F., mercury requires a temperature of 675.°F.

Pressure-Lbs. Sq. In. Abs.	Water Boils at	Mercury Boils at
0.5 (29." vacuum)	79.°F.	413.°F.
14.7 (atmosphere)	212.°F.	675.°F.
155. (Present mercury boiler condition)	361.°F.	975.°F.
3226 (Critical pressure for water)	706.°F.	Possibly 2800.°F.

It has already been stated that the efficiency of any cycle is dependent upon its two extreme temperature limits. Since the lower limit of the steam cycle is fixed by nature in the temperature of the river or lake circulating water in the condenser, the only possible gain is by raising the upper limit. Alteration of the cycle by feed water heating so that the major portion of the heat is added at the upper limit will help some. But water, operating at its critical pressure, will form steam at only 706.°F. and, while steam may be superheated to higher

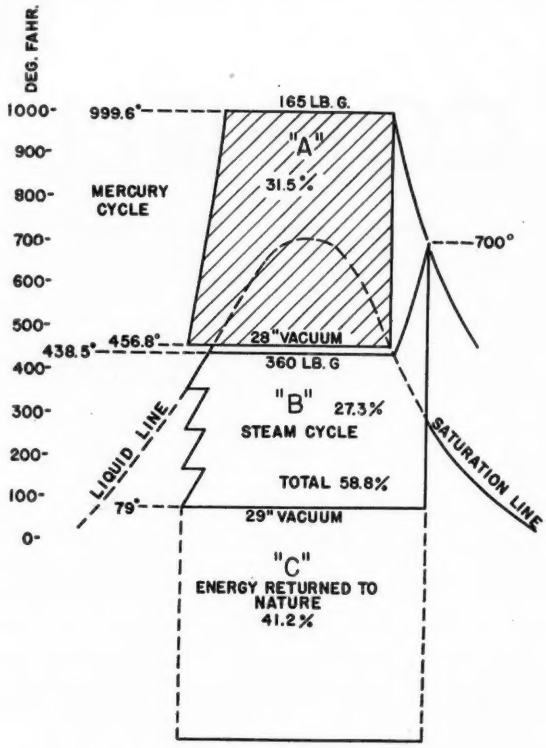
temperatures, only a small proportion of the total heat energy can be put into it by this means. The reason back of the gradual increase of the operating steam pressure during the past decade has been to raise the upper temperature limit of the steam cycle and improve the station efficiencies.

The ultimate temperature limit of the steam cycle had been foreseen by Mr. W. LeRoy Emmet. An inventor, Mr. Charles S. Bradley, suggested the use of a binary cycle. Seeing the possibility of superimposing or placing the mercury cycle on top of the existing steam cycle, with the resulting gain in efficiency, Mr. Emmet began his development work in 1912. It has been long and expensive major development but the idea was based on sound fundamentals and the results are now proving it.

The Binary Cycle

The combining of two fluids in a binary cycle can best be explained by a temperature entropy diagram, see Fig. 1. The block of power represented by "B" is obtained from steam. The steam is formed in a boiler by heat transferred from burning fuel and used in the steam engine or turbine at the upper limit indicated on the diagram, and exhausted at the lower. The exhaust steam has still considerable energy in it which is represented by the block of power "C". This is rejected, either to the surrounding air or circulating water. Therefore, for this straight steam cycle only 27.3% of the energy of the steam is theoretically available for useful work. This percentage can be increased some with higher operating temperature but is limited by the dome of the curve.

The procedure of superimposing another cycle, the block of power represented by "A", is the only recourse left. This is obtained by the use of mercury. Vapor is formed from liquid mercury in a boiler of its own by heat transferred from an increased amount of burning fuel. The amount of fuel has to be increased, over that previously burned to supply heat to "B", by the amount of energy represented by the block "A". The vapor at the upper temperature limit is used in a separate heat engine, or in the actual case a turbine, and exhausted at the lower limit of the mercury cycle. With still sufficient temperature it gives up its heat of condensation to water in a heat exchanger, or what is termed a condenser-boiler, forming steam at the upper limit of the steam cycle. Thus theoretically the additional block of power "A" and the block of power "B" are available for useful work, while the block "C" which is the rejected power remains the same. The sum of "A" and "B" gives 58.8% compared to the original 27.3% for "B" alone. On a more practical basis the percentage of the heat value of coal converted into electrical energy at the switchboard in actual power station practice is 27.% for the best steam stations. For the present mercury steam stations the percentage is 36.%.



MERCURY—STEAM TEMPERATURE—ENTROPY DIAGRAMS
FIG. 1

Here is a gain of 33.% over the best steam plant and it runs about 50% for the average steam plant. Such thermal economies represent about a pound of coal for each kilowatt-hour produced by steam plants and two-thirds of a pound per kilowatt-hour in mercury steam plants.

In practice, the effective heat rate of the mercury section of the plant is about 4,000 B.t.u. per kilowatt-hour. It was mentioned in the preceding paragraph that the amount of fuel burned with its resulting heat transfer to the mercury cycle, block "A", has only been increased over that supplied to the steam cycle "B" by the energy represented in "A". This assumes that the mercury picks up the heat in the fuel and produces useful work at a 100.% efficiency. Actually this is true except for the small losses represented by the bolier efficiency, and the mechanical and electrical losses of the turbine and generator. On the basis that the heat energy of the fuel ultimately ends in the steam cycle, it might easily be considered that the superimposed mercury cycle produces by-product power as it conveys the heat pick-up from the fuel to the steam cycle.

Mercury has proved to be an almost ideal working

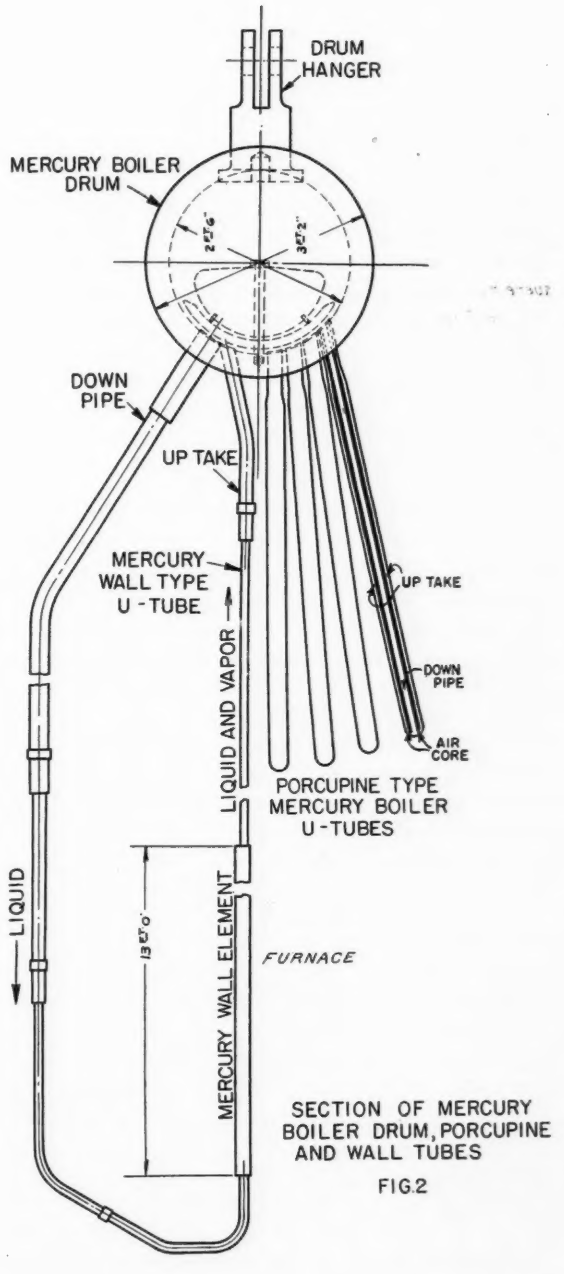
agent for use at high temperatures. The pressures are low so that the stresses in the boiler and turbine parts can be kept within the allowable limits at the operating temperatures. Its latent heat of vaporization over the temperature range required is very large in comparison with its sensible heat. Hence the liquid line on the mercury temperature-entropy diagram is nearly vertical, approaching much closer than steam to the perfect Carnot cycle. As for heat transfer, tests have indicated that mercury liquid flowing through a tube has a heat pick-up several times that of water.

Disadvantages

There are, however, some disadvantages. Mercury is expensive, costing approximately $1.00 a pound, and a pound isn't much when you consider its density. A cube of mercury, approximately an inch and a quarter on each edge, is equivalent to a pound. Precautions, therefore, have to be taken against leakage. All the parts under mercury pressure are either inside the boiler casing under stack suction or surrounded by sealed steel casings connected to the stack. If leakage of mercury occurs in any part of the apparatus it passes out with the stack gases. There are two methods used, one chemically, and the other electrically, for the detection of minute quantities of mercury in the air or stack gases. Both of these methods are in continuous use and positive indications of one part of mercury in twenty million parts of air by volume are recorded and the operator notified by means of an automatic alarm bell. In case a mercury leak of any size develops in the boiler parts enclosed in the flue, water sprays are turned on in the stack to condense and save the mercury in the flue gases.

Boiler Construction

Now, let us consider the boiler in which the mercury is vaporized and its path of operation. The tubes which pick up the heat of the burning fuel are in all cases some type of a U-tube with the top ends connected to the boiler drum. This U may be incorporated in a single tube by having one leg, acting as the feed or down-pipe, in a hollow air core, and the other leg, or up-take, being the annular clearance between the hollow air core and the inside of the outer tube. This type of boiler tube has been used during the past ten years and is known as a porcupine tube due to the appearance of a group of them hanging from the bottom of a horizontal drum. The form of U-tube which has been developed and used more recently is that which constitutes a wall tube in the furnace. A feeder or down-pipe leaves the main boiler drum an dcarries liquid, to the bottom of the U. This is outside the furnace so it does not receive heat. The up-take part of the U is a group of vertical tubes forming the walls of the furnace, fed at the bottom by the down-pipe



SECTION OF MERCURY BOILER DRUM, PORCUPINE AND WALL TUBES

FIG.2

and connected to the same boiler drum at the top.. Fig. 2 shows a group of porcupine tubes in section attached to the bottom of a boiler drum and also a wall tube with its down-pipe. These tubes are of low carbon steel and are

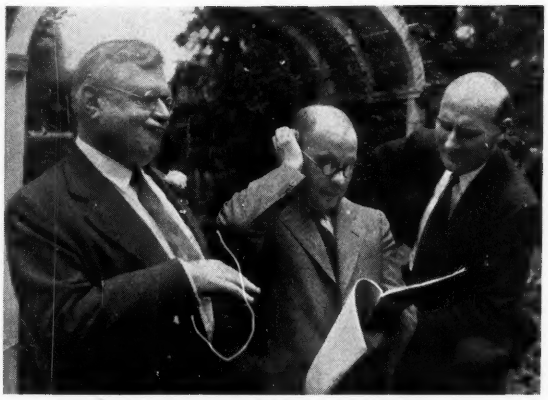
(Continued on page forty-six)

The Science and Art of Living

By Vladimir Karapetoff

Professor of Electrical Engineering

At his last lecture before the senior class of students in electrical engineering in May 1935, Professor Vladimir Karapetoff, Cornell University, spoke on the "Science and Art of Living", urging his students to give it a constant thought, over and above all specific studies, tasks, avocations, or pursuits. He reminded them of the best men whom they had met and admired, and how those men were not mere agglomerations of virtues, skills, good manners, and such, but always presented a definite personality. One could almost predict how they would act or what they would say in any given circumstances, and what they did or said was wise, proper, considerate of others, and often served as an inspiration to do likewise. He said in part:



A "KARYCTERISTIC" POSE
Taken at the AIEE Convention

"In our complex social structure it is difficult for one so to co-ordinate one's knowledge, experience and ideals as to present a unified superior personality adapted to its surroundings and yet capable of raising these surroundings to a higher level. The sum total of the efforts which a person makes to achieve these results, together with the achievements themselves, I call the science and art of living, in application to that person. Leaving out lop-sided geniuses, and near-sighted selfish men, all of us could and should present such unified albeit individual personalities to the external world, and these personalities can only be socially minded, for all anti-social tendencies are self-destructive in the long run. The science and art of living includes virtues, some skill, tact, patience, experience, knowledge of history and human nature, and many other things, but it is greater than all these put together. Let us say, when you watch the opera Aida in a beautiful setting and sung by eminent artists you get a unified idea of the composer's design as realized by the stage manager and the conductor. Even though there are innumerable details of singing, instrumental skill, costumes, dancing, scenery, dramatic art, and what not, all harmoniously contributing toward the same goal, yet the opera such as you experience and admire is immeasurably greater than all these details.

"In the same way, a recent college graduate is likely to possess many fragments of facts, theories, ideas, ideals, manners, endeavors at sports or arts, human experiences (satisfying or otherwise), and above all a dim apprehension that he is a human being among millions of others and that it is for him in addition to finding a job, to find his place. As years go by, some succeed in rounding up and supplementing the fragments of the college years into a pattern of mosaic, however simple and imperfect. A great majority go to their graves still carrying the fragments with them, not even conscious of the fact that their lives stand for nothing and express nothing after thousands of dollars spent on their education. The science and art of living is the continuous process whereby you try to make a more and more beautiful pattern of the elements of your mind and body, adding minute colored stones, polishing the rough edges of those you already possess, throwing away those which do not fit in hue or in shape, and constantly verifying your endeavors in your relationships with those with whom you come in contact.

It is not true that the first step towards learning something is to know how. The first and the most important step is an intense desire to learn a particular thing. In a modern civilized society it is not difficult to find instruction in any subject, so long as you are willing to make a systematic patient search, or wait for a proper opportunity. The purpose of my talk is to arouse in you a desire to add the science and art of living to your other accomplishments or to a long list of your life aims. Sit down and gradually evolve a picture of yourself, such as you desire to be. I do not mean by this a childish picture of a young man such as you see in magazine advertisements, rich, idle, good looking, and surounded by attractive girls. I mean a picture based upon your particular strong points and propensities properly developed, and with your known weaknesses eliminated or reduced to a miniumum. You may like teaching and expect to become a teacher. Then build your ideal on this foundation and try to see as clearly as possible what kind of man you would like to be say twenty years from now. Or you

may expect to go into sales and administrative work. If so, do not picture yourself as a boss ordering others around and marrying the president's daughter. Picture yourself as a subordinate who knows how to obey intelligently, who sees beyond his little corner in the office, and who steadily rises on a spiral because of his sound knowledge, excellent judgment, an attitude of service, and a sterling character. If you aspire to a career of research and science, do not indulge in day dreams about a Nobel prize or an invention readily sold for two million dollars. Think of yourself as a poor laboratory assistant, humble and patient, hard-working and undaunted by repeated failures. Add to this a creative imagination which sees beyond test tubes, jars, and coils; a desire to co-operate and to give other workers more credit than they deserve; add to this an ability to express yourself clearly and forcefully, and you have a first crude pattern of a mosaic in your chosen field. Then work on this pattern day by day and year by year, correcting and changing it, and letting an appreciation on the part of others be an entirely secondary factor. The famous astronomer Kepler once wrote in one of his books: "I may well wait a century for a reader, since God has waited six thousand years for an observer like myself."

'I purposely have abstained from mentioning specific details, such as correct etiquette, reading biographies of great men, active participation in the affairs of some worthy organization outside your regular job, training yourself in restraint for the good of others, working patiently on weaknesses in your mental or physical make-up. An appreciation of such specific points of a big program cannot fail to come in time. The important thing is to become inspired in turning into a freshman again, a freshman in the big University of Life in which the Science and Art of Living is the only required subject, with no substitutions allowed".

Camp Cornell, 1935

By George Kaye, A.B. '36, C. E. '38

It was the third Friday in August and the last day of the summer session, when the good people of Ithaca sat back in their seats with a sigh of relief. At last the hubbub that had prevailed all summer was to cease, and the peace and quiet so native to their fair city was to be restored. But in the midst of the general exodus, several peculiar individuals were seen here and there inconspicuously entering the town—not totally strangers, yet to all recollection—newcomers. Much was the alarm of the good citizens to find the number of these newcomers increase by the hour. Their fears were heightened when Saturday and Sunday gave evidence of much celebrating and carousing about town. The climax of it all came on Monday morning, August 19th, at eight o'clock, when there was a great clamor in the vicinity of Lincoln Hall. Were these newcomers messengers of destruction from some rival educational institution? Were they a part of some savage people who for some unknown reason had chosen that spot for their voodoostic inclinations?

The braver individuals who dared approach soon had their fear dispelled, for there came upon the scene a man of much repute and respect among the townsmen, and a member of the faculty of the School of Civil Engineering —Professor Underwood. Confusion and chaos gave way to absolute silence, and the crowd to a man (and woman) filed into Lincoln Hall. It was later explained to the bewildered populace that the Juniors (with a sprinkling of Seniors and Foresters here and there) of the School of Civil Engineering were convening for the organization of the sixty-second annual Summer Survey Camp, and the boys had merely been expressing their effervescing emotions at seeing each other again.

Since there were less than two score potential surveyors in the group, it was found that Room 26 sufficed to keep those "back-to-nature" men restrained long enough to outline in very brief form just what the plans were for the five week period. In the course of the meeting there were organized six parties of from five to six men each. The area to be surveyed was divided up into six plots averaging ½ a square mile, all lying to the north and northwest of Cayuta Lake, and to each party there was subseqently assigned one of these plots. What with the floods in the early part of the summer, most of the boys imagined that the greatest part of the work would fall under the head of Hydrography. Fortunately, however, most of the waters had receded by then, and the major part of their contact with water was as a means of transportation in search of greater adventure. After instructions were given us as to ways of getting to camp and arrangements were made for the transportation of baggage, the meeting broke up, to readjourn at camp at eleven o'clock.

Upon arriving at camp, we found, much to our pleasure, that the hardest part of making camp had already

been finished. The tents were already up and literally craving for occupancy. It took but an hour to put all the instruments, tables and other equipment in order, and by noon we were all quite prepared for a hearty lunch. After devouring the man-sized meal offered us, we proceeded immediately to the adjustment of our instruments and the determination of our stadia constants. Meanwhile, several members of each party had been selected to put the finishing touches on the camp necessities. Dinner was held in royal style as the mosquitoes extended their formal greeting, displaying their most intricate acrobatics and maneuvers much to the dismay of those thusly honored. It was with much jubilation that we heard Professor Underwood extend a blanket leave to us all, and we promptly set out to utilize it in a general tour of inspection of the surrounding country and all its "landmarks".

A Typical Day

The sun broke through on the morning of August 20, and with a blaze of glory beat its rays down upon some dozen or so tents, wherein lay the weary heads and bodies of some 37 Cornellians. But lo, the sun, mighty though he is, was not powerful enough to cause that slumbering throng to awaken. It remained for the one and only John McManus to accomplish this feat, when at 6:00 A.M. he emerged from the mess hall and proceeded to beat heavily on his indispensible black tray. The din succeeded in rousing the unsuspecting multitude, who burst forth with cries of indignation. But by the end of camp, the aforementioned din became so much a part of one's morning sleep that complete rest was never achieved without it. At 6:30, the noise was repeated with less vehemence, but the response this time was more commendable. This call signified the advent of a warm, invigorating breakfast, at the end of which we were all presented with lunch bags containing from three to six units. A unit, may we add for the benefit of the uninitiated, was to be known as a sandwich, a fruit, an egg, or some cookies. It became one of the pastimes to ask for the most ludicrous units and in the most inconceivable number (Waldron once asked for waffles). Most of us are to this very day uncertain as to the methods employed by one of our more voracious members— a track man by repute—who always seemed to have more sandwiches and other victuals at his disposal during the noon-day respite. At 7:30, the various parties set out for their respective plots, while several men were assigned to special duties such as Triangulation, Precise Levels etc., as posted on the bulletin board (made by our ever obliging and practical Art Glasser). What with only thirty minutes for lunch, it was an exhauted 'gang' of engineers (save for the heartest of all, our own Phyllis Weldin) who made for camp at 4:30. From 5 to 6 o'clock activities were varied. Some took showers, others went swimming, while some few unusual individuals went so far as to attempt to straighten out their personal effects which had been strewn all over the place in the rapid succession of events.

Plane Table

6:30 again brought food in the form of a hearty dinner, a pastime of great favor after all the day's activity, and at 7:30 all assembled in the Mess Hall for a two hour period of computation and mental (?) strain. The day was formally brought to an end at 9:30, and let me assure my readers that during that first week, it wasn't long after 9:30 that each and every one of us was fast asleep.

Topography

Such was the typical course of events of a day, varying only insofar as one's individual activities were juggled by the able manipulation of the administration. During the first three weeks, emphasis was placed upon Togography. This branch of the work was under the supervision of our ever jovial but militaristicly adamant Professor Perry (remember the Boy Scouts?). It was the duty of each party, left for the most part to their own devices, to run stadia traverses accurate to at least one in four hundred, for the subsequent purpose of recording detailed topography for mapping. Each party met with its own peculiar difficulties, and loud was the lamentation each evening as the several captains discussed their problems.—Barton bewailed his fate and complained bitterly of the injustice done (to which I agree,—your correspondent having been in his party) in assigning his party a plot consisting largely of almost impenetrable swamp land. Whereupon he was guffawed at by Sturdy and Godley, who claimed their mountain was so steep they had to cut steps in it to get up to the top. Others reported handicaps of stationary and movable character, ranging from thick woodlands to herds of bulls (?). Party C, coaxed and pleaded with by "South America," "Frank Buck" Ray Palmer, had to contend with the ever hungry look of Harlow and the machinations of "Tiger" Mills and "Deadeye" Barber. Yet with all the good sport, real work was done, and it was not necessary to burn any midnight oil during the last week,—save for those unfortunates who had difficulty with their Sun Azimuths.

With his usual degree of administrative skill and engineering exactness, Professor Underwood plotted our

(*Continued on page fifty*)

STRESS and STRAIN

Don't let Park Stacey's serious demeanor fool you—he has a sense of humor that is subtle and diabolical, or something—anyhow, we were almost thrown for a loss by one of his cracks. The class was discussing the flight test of a new airplane, that had been designed by someone who had never read Prof. K. D. Wood's books. As could be expected from this grevious omission, the plane was unstable. It took off all right, and climbed a few hundred feet—but then a gust of wind hit it, and it dived abruptly to the ground. Stacey went into details—"There was a wire mesh around the cockpit to protect the pilot in case of crash", he explained—"but it filtered him".

* * *

Prof. (heat power) Clark has a method which he guarantees infallible for getting to inspect parts of plants and labs, where the public is strictly excluded. You simply take off your coat and hat, grab up an armful of blue-prints, look important, and—you can go where you please and find out what you like. We could take of our coat and hat, Professor—and there's no trick to grabbing up an armful of blueprints—but how about a course—credit two hours, no prelims—in looking important?

* * *

They tell a story about the suspension bridge. It wasn't told to us—we only heard, and this department disclaims all responsibility for the whole thing. Anyhow, using this mag. for libel—or anything else, for that matter—would be a pretty futile waste of time. It seems that a C.E. was writing a thesis for his Master's, and, for lack of anything better to do, he designed a new and different suspension bridge. In due time he received his degree, and left these stately halls. A few years later, the administration was looking around for something to spend money on, and happened upon the thesis. It looked pretty good on paper, so they took a tape measure or something and tore up and down the gorge till they found a width that the bridge would fit. Before long, theory became fact, and the slim structure was swaying far above Fall Creek's meandering trickle. Came June, and the innocent designer of the edifice returned for reunion, bringing with him the wife and kiddies. Strolling about the campus, he spied his handiwork. It couldn't be—yes, it was! There was no mistake. He turned and ran, hell bent for salvation, to where his wife and kiddies were staying, and enjoined them, with the direst threats, never to go near the suspension bridge across Fall Creek. . . . .

* * *

Richard (Katzy) Katzenstein designed a pretty fine looking plane in K. D. Wood's course last year. The thing looked pretty stream-lined, and the engine was covered by a simple but dignified cowling. We were impressed until Katzy confessed that the reason he had a cowl was that he couldn't draw the side view of an engine!

* * *

According to the *California Engineer,* last year's graduating electricals have learned how to apply their knowledge in a practical way. They are using Ampere's "right hand rule" to obtain transportation.

* * *

We are indebted again to the *California Engineer* for some definititons found in prelims.

Time is the thing that keeps all things from happening at once.

A Charpy impact tester is a cross between a clock and a guillotine and is used in this experiment for testing your mettle.

An electron is a dot of electricity that speeds very fast backwards from the direction that electricity actually goes and it loses this sense of direction and gets turned around where the magnetic field is fluxing.

—o—

Perhaps one of the best anti-pledging excuses uncovered this fall centers about Jim Ferris '35 M.E. Jim decided that for some graduate work it might be fun to live in the dorms once more. So properly ensconsed, he hoped against hope that during rushing some unsuspecting sophomore might mistake him for a rushee, when low and behold, that's just what did happen.

Not wishing to spoil the fun at the outset, the proferred date was accepted, and the next day another. After a day or two of quiet, Jim was again approached by the same house and bid. Can we be expected to know everyone on the hill ?

* * *

To the Cornell Freshman of the current year, the I. T. C. means nothing more than another spoonful of alphabet soup. However, the remainder of the Cornellians the world over recall with a wry smile some now humorous incident connected with Ithaca's rickety rail cars.

As an illustration, some of us recall the time when Jack Harlow, accompanied by several of his fraternity brothers, felt that the hill was too cold a walk after the late night show. Not being able to promote his plan of a street car ride, he was left alone to wait for the last car. After an interminable period, it came, and Jack settled down to snooze before being let off in front of his house. Now he is still trying to determine how he ever made it up the hill after waking up a half hour later when the car had completed its trip and was being put to bed.

THE CORNELL ENGINEER

PUBLISHED MONTHLY DURING THE COLLEGE YEAR

❖ EDITORIALS ❖

THE FORGOTTEN MAN

If there is one principal reasan for the success of engineers in the solving of the construction problems of the modern projects, it might well be called research.

The public represented by "John J. Average-citizen" readily acclaims the resulting structure and praises the builder, and this party has every right for the praises, but the sad part is that who have made these structures possible are given little or no credit for their work, and in most cases receive a very small monetary return for their labor.

The man who made even the thought of the edifices of today a reasonable dream is not the man who draws graceful lines on a piece of paper and is congratulated for his cleverness; he is not the man who commands the workers in the field and is classed as a man of action; the man, or more truthfully, the men, who have made the building of the modern structures possible are the men of the research lab.; the men who have developed the principles for the design of the buildings; the men who have tested again and again the materials of construction in order to find the flaws in the materials and to correct these flaws; the men who have set up the standards for the use of these materials.

All the more reason for the credit going a little less to the constructor and a little more to the man behind the scenes, is the return that he derives. Where the contractor and his employees receive a high return for their labor the research artist has a very small return. Where the builder is something of a glamorous figure and is an example of a successful man, the man of the laboratory is usually pictured as the example of what not to be, the normal conception being that of a putterer or of a eccentric machine.

The man behind the scenes is in most cases quite willing to do the work in his field without a protest as to who derives the benefits of his efforts, but if every once in a while the people would upon seeing a new engineering creation give a moment in appreciation of his efforts it might easily give him a little more incentive for advanced work and at the same time sooth the pangs inflicted by the minute monetary returns of his labor.

—o—

EDUCATED PLUMBERS

It has long been a tendency of our more erudite brethren in the Arts college to consider the engineers rather scornfully as being students in a glorified trade school. To their minds, the engineers are not educated, at least in the sense that they have anything resembling a liberal education; and to most Arts students, a so-called liberal education is the only thing that is worthy of the name. To them, an engineer is in the same class with plumbers, machinists, and similar classes of trademen, except that the engineer has gone to college for four years and hence knows more about theory than does the ordinary laborer. But so far as being educated is concerned, the average engineer has not even been exposed, if you believe our friends, the Arts students.

All of which is a rather exaggerated point of view; but one which, nevertheless, has a substantial basis in fact. We must admit that the average engineering student can find little or no time to devote to the cultural side of his development. He finds it necessary to spend nearly all of his time on his work which is directly connected with engineering. There are a few who manage to find some time in which to indulge in the various opportunities for

cultural development which are so numerous here; but they are the exception, rather than the rule. The ordinary student would like very much to enjoy the cultural advantages of university life to their fullest extent, but he is so burdened down by his work that he finds himself unable to do so.

There could be only one way to remedy this situation; but the difficulties incurred by an attempt to remedy it might more than offset any gains that might result. The only feasible solutions would be to lengthen the engineering course, or to reduce the amount of work which it covers. Either one of these measures would give the engineers more time to get more cultural education, but at the same time would involve severe difficulties. To increase the length of the engineering course would increase its cost, and put it out of the reach of a large number of students who would be unable to stand the added expense. On the other hand, it would obviously not be feasible to cut down the amount of work covered, without at the same time lowering the standard of the training given. The whole matter revolves about the point that the science of engineering has advanced to such a degree that it is no longer possible to cover the field adequately in four years, without having to sacrifice some of the cultural development which should be a part of a college education. In view of the difficulties which arise if an attempt were made to change the situation as it exists, it seems to us that the only thing possible is to accept things as they are, and that cultural development must wait until after graduation to receive the full attention which is due to it.

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STUDENT ENGINEERING SOCIETIES

The first meetings of the local branches of the national engineering societies have been held on the hill this year. Speakers have been presented, telling of recent developments in their respective branches of the engineering field, and as the year progresses, each society will bring an average of one noted engineer a month to speak on something new with which he has been intinmately connected.

To the seniors this is an old story in many cases, and they attend these meeting for the purpose of broadening the education that they are acquiring and hearing interesting speakers. Since the membership is open only to the Juniors and Seniors, the incoming junior has never attended one of these meeting and knows little about them.

After the engineer completes his formal engineering education and leaves his campus, his only medium of keeping abreast of the times in his profession is through a reliable engineering paper and informed speakers on new topics. That a man do this is imperative if he is to obtain the position that he desires, that of a leader.

Since the majority of the reliable papers are sponsored by the engineering societies, and it is through these societies that advantageous contacts are made, it is desirable to be affiliated with such a society atter graduation. There, through participation in the activities of the organization can the member meet the leaders of his industry and obtain new ideas, and ideals.

By being a member of a junior branch of his respective society while in school, a man can much more easily slip into his position after graduation, and at an earlier date begin to acclimate himself to his new suroundings and work. That the student is beginning to realize this, is being shown by the marked increase of the attendence at these meetings during the past two years. With the wealth of research done in the past few years of the depression, the speakers promise to be more interesting and instructive than ever before, which will undoubtedly keep the membership climbing.

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GET OFF THE FENCE

And now in Europe Italy has started to take by force of actual warfare territory from which she claims the Allies had cheated her. Germany, blindly following the leadership of an insane genius, is arming to the teeth. France is watching developments jealously, and has appropriated a huge sum for greater armaments. Japan refuses to consider military strength less than that of England, and in the United States, the government has ordered a fleet of new fighting airplanes.

The time has come for every individual to review the situation and to take his stand on the question of war or peace, militarism or pacifism. If he believes in "armed preparedness" as a means of preventing war, he should be very sure that his theory is tenable—that the nations of the world, while racing each other to bigger and better armaments, will live together in cooperation and loving-kindness. If he is a sincere pacifist, he should decide what hardships and insults he would be prepared to endure for his ideals.

Engineers particularly should take for themselves definite and well-considered stands; for while it is engineers who have made possible bridges, autombiles, radios—the material things that make for varied and graceful living —it is also they who have built machine guns and tanks and bombing airplanes.

While the only way for an individual to determine his own stand is for him to think, clearly and honestly, looking at the various aspects of the situation as they are and not as he would wish them to be, much aid to this thinking can be obtained thru reading and thru talking with contemporaries. Beverly Nichols, to help himself determine his stand on this question, has written a book, *Cry Havoc,* in which he has presented many sides and viewpoints help, perhaps more than anything else, in finding ones position. We believe that this book should be read by every one in the world who can read—and be read to the rest of them; for the time has come for everyone to make up his mind, intelligently and definitely, as to exactly where he stands. *Get off the fence.*

CORNELL SOCIETY of ENGINEERS

EDWARD C. M. STAHL '13, President

J. D. TULLER '09, Vice President | S. C. HOLLISTER, Vice President

EDWARD B. KIRBY '25, Recording Secretary | JOHN P. SYME '26, Secretary and Treasurer

"The objects of this Society are to promote the Welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the college and the alumni."

President's Column

October 31, 1935

Fellow Members:

The officers whose names appear in the heading were elected for the ensuing year at the annual meeting of your Society held on October 23, 1935, at the Cornell Club of New York. One of the Vice Presidents is always an active member of the faculty. The Executive Committee, composed of the officers, the four latest living past Presidents and five members at large, constitutes the governing body of the Society. The four past presidents are C. H. Davidson '11, John H. Lawrence '09, R. W. Gastmeyer '11, and R. W. Weed '09. The members at large are: Walker L. Cisler EE '22, Bert Houghton ME '92, T. S. Chadeayne CE '36, Donald English and one still to be appointed. C. M. Chuckrow CE '11 is the Society's appointee on the Engineering College Council.

In addition to the Executive Committee, there is an Engineering College Council, a group of nine alumni, three from each of the engineering schools. Your Society was instrumental in having this council appointed and its functions are advisory to the Trustees, University and Engineering College faculties. One member of the Council is appointed by your Society, the remainder by the President of the University. Overlapping terms are provided for, three members being appointed each year. The present council consists of:

C. M. Chuckrow	'11	CE	New York, N. Y.
Ezra B. Whitman	'01	CE	Baltimore, Md.
James W. Parker	'08	CE	Albany, N. Y.
James Lynah	'05	ME	Ithaca, N. Y.
C. R. Vanneman	'03	ME	Detroit, Mich.
M. M. Upson	'99	ME	New York, N. Y.
L. W. W. Morrow	'11	EE	New York, N. Y.
F. D. Newbury	'01	EE	Pittsburgh, Pa.
A. C. Stevens	'07	EE	Schenectady, N. Y.

From the above brief perspective it is evident that the alumni have an organization which is effective in fostering the interests of the Engineering College and enhancing the reputation of the College and its graduates.

Your present officers hope to bring to fruition a few more of the long range policies of past administrations. With your interest and assistance this can be done. C. H. Davidson, retiring President, summarized these aims in last month's issue. He appointed committees which are actively pushing toward their objectives and their work is already showing gratifying results. You will hear more about these from regional headquarters of this Society, but for emphasis and your convenience the immediate objectives are repeated. First—Increase the membership of the Society and the circulation of The Cornell Engineer. Second—Form local chapters of the Society in centers other than in New York. Third—Provide support for the employment agencies for Cornellians in Ithaca, New York, and where possible in other centers. Fourth—Provide, through increase in the size and influence of our coordinated group, means whereby the needs and projects of the Engineering College at Cornell may receive the necessary publicity and support.

Fundamentally this Society exists solely for the purpose of furnishing a channel for the utilization of the loyalty, energy and interest of 14,000 engineers, in furthering our own welfare and that of the College which trained us. These interests may be readily expressed by INDIVIDUALS in many ways that will be of direct and mutual benefit. A few are—(1) Contacting the University Employment Bureau when seeking technical employees, or when looking for a change in your own employment, (2) Encouraging prospective students to try for the newly created regional scholarships, (3) Solicitation of faculty discussion (for inclusion in the transactions) of papers which you are presenting before meetings of any of the National Engineering Societies, (4) Review and discuss recent text books by members of the faculty and advocate the inclusion of these books in industrial and other libraries, (5) If associated with an out-

standing engineering project in any branch, contribute newsy and human interest articles about it for this magazine, (6) Boost this magazine and when possible influence an advertiser to take space in it, and (7) Above all, get acquainted or re-acquainted with Cornell Engineers in your locality. Any one or all of the above items is a purely individual matter and yet if carried out will materially further the aims and objects of your Society and give you much personal satisfaction.

If you have read this column, which we hope an ever increasing number will do, take a little time to ponder over the situation as outlined above, add your ideas and suggestions to them and write us.

We sincerly hope that succeeding issues of this magazine will be eagerly anticipated, and with the proper spirit and cooperation from you all we can promise that it will be.

Very sincerely,
EDWARD C. M. STAHL, *President*

P.S. Communications should be addressed to The Cornell Society of Engineers, % Cornell Club, 245 Madison Avenue, New York City.

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1935 ANNUAL MEETING OF THE CORNELL SOCIETY OF ENGINEERS

The annual meeting of the Cornell Society of Engiieers was held on October 23 at 6:30 p. m. at the Cornell Club of New York. The election of officers for the ensuing year was carried out and the names of these officers appear in the head of the Society's page.

The speaker of the evening was Dr. Edwin W. Kemmerer. He was a Fellow in economics and finance at Cornell in 1899 to 1901, Professor in Economics and Finance at Cornell from 1906 to 1912 and is now Research Professor of International Finance at Princeton. He has served as Financial Advisor to many countries among them Mexico, Union of South Africa, Poland, China, Peru, Columbia and Chili and is well known for his outstanding speeches and numerous works of financial and monetary subjects.

One hundred and thirty-five engineers were on hand for the dinner and a goodly number dropped in later just for the meeting. The following were a few of those in in attendance: M. C. Rorty '96, Bert Houghton '92, D. H. Dixon '96, E. J. Moore '99, Walt King '07, John H. Lawrence '09, Wm. F. Burdette '98, Wilton Bentley '98, Edw. Cole '94 and R. H. Shreve '02.

After Dr. Kemmerer's most interesting talk a great deal of discussion developed among those present and the meeting continued for a long time. Unfortunately for our readers, Dr. Kemmerer had been promised that there would be no publication of his remarks, but those who attended the meeting were well repaid in the information which was disseminated.

ANNOUNCEMENT

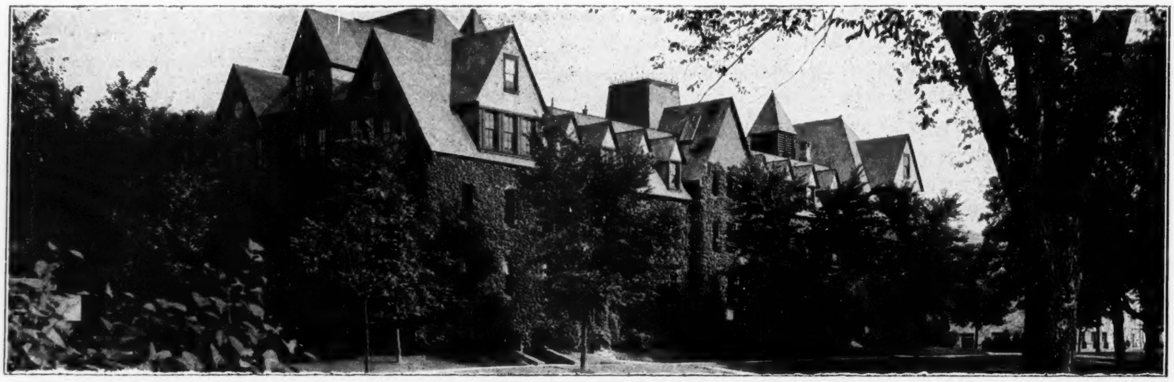
The Cornell Society of Engineers will hold an informal gathering in accordance with its past custom on Thursday evening, December 5, for Cornell engineers attending the annual meeting of the American Society of Mechanical Engineers. Courtesy cards extending the privileges of the Cornell Club of New York will be available at the club desk for Cornell engineers in town for that week.

CONGRATULATIONS

The board of the CORNELL ENGINEER takes this opportunity to congratulate the newly elected officers of the Cornell Society of Engineers and to commend the members of the Society on their choice of leaders. We feel sure that under the able guidance of these men the Society, and through it the College of Engineering, will continue the rapid advancement and development begun under the retiring officers.

With the use of THE CORNELL ENGINEER as an organ of the Cornell Society of Engineers, this organization takes on new significance. We alumni of Cornell are faced with a somewhat different situation from that of other outstanding engineering colleges. As Cornellians we think of ourselves as engineers, architects, lawyers, doctors, agriculturists and graduates of the school of arts and sciences. That very fine broad diversity leads us most rightfully to think in terms of Cornell as the entire institution. Engineering graduates naturally cannot always think of Cornell only in terms of engineering, for our football team, our leading graduates, and our professors came not solely from engineering, but from every other college in the University. On the other hand, the graduates of a number of other leading technical schools specializing in engineering can concentrate their thoughts and alumni activities solely on the engineering point of view. At Cornell, we have what might be called "dilution" and this often seriously affects the much-needed alumni interest in the College of Engineering at Ithaca. This magazine furnishes your Society an added means for consolidating the engineering interests at Cornell.

(Signed) John P. Syme '26



COLLEGE

TAU BETA PI

The following men were elected to TAU BETA PI on Thursday, October 31:

R. W. Baunach '36 C.E., W. L. Chewning '36 A.E., J. C. Delibert '36 C.E., W. W. Fisher '36 A.E., D. C. Graves '36 A.E., H. S. Godshall '36 A.E., W. R. Harry '36 E.E., F. D. Hart '36 M.E., D. W. McNulty '36 Arch., D. D. Moretti '36 A.E., J. L. Patterson '36 Arch., H. H. Sturdy '36 C.E., J. Sullivan Jr. '36 Arch., R. V. Vittucci '36 M.E., W. Wiitanen '36 M.E., R. C. Winans '36 E.E., J. R. Young '36 M.E., L. A. Doughty '37 Arch., F. F. Sampson '37 A.E., J. R. Ware '37 M.E..

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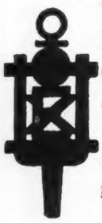
CHI EPSILON



The following men were elected to CHI EPSILON, National Honorary Scholastic Socity in Civil Engineering on Friday, October 25:

C. J. Rossow '36, H. H. Sturdy '36, J. T. Barton '37, L. A. Christensen '37, B. Rodriguez-Santos '37, J. R. Wandling '37.

There will be a formal induction and banquet on November 26 in Willard Staright Hall.

* * * *

A. I. E. E.

The opening meeting of the student branch of the American Institute of Electrical Engineers was held Friday evening, October 11, 1935, at Franklin Hall. At this meeting Mr. A. C. Stevens of General Electric Company and Secretary-Treasurer of Northeastern District presented some very interesting sound pictures and a talk on the activities of the Institute. After the talk refreshments were served.

This year the AIEE plans a very interesting program of meetings at which prominent speakers in the field are to be presented as well as a number of papers and talks by students of the school. Every effort is being made to make the student body of the school more united and more interested in the various fields of endeavor of the members of that body. A successful membership drive has resulted in record membership and this in itself is an indication that student interest in the Institute and what it's standards is not lagging. This increase in interest may well be attributed in part to the annual Spring Electrical Show which has proven so successful in the past. The show not only gets the men of the school together on an informal basis with their instructors but also creates a spirit of fellowship and interest in the profession.

* * * *

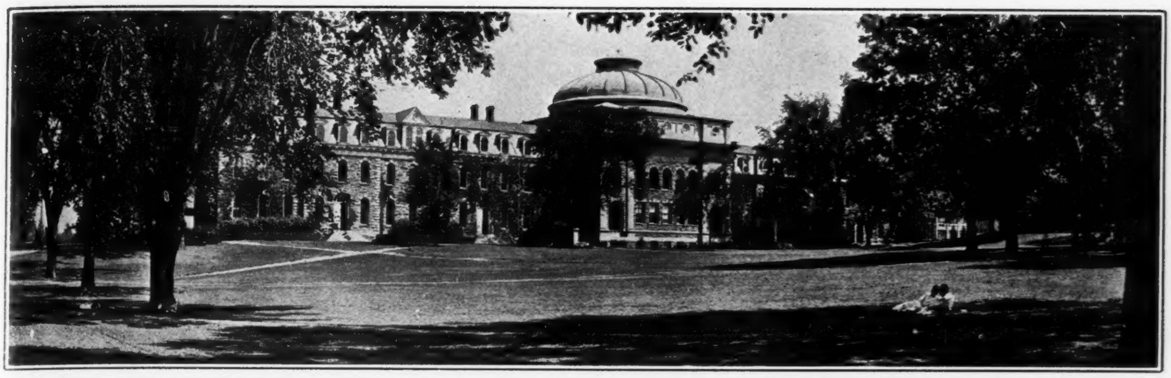
REVIEW OF C.E. ATHLETICS

For the Spring term of 1935, considerable improvement was noticed both in the interest taken, and in the success achieved by the Civil Engineering School in intercollege sports. With a good start, namely the winning of the intramural swimming meet, the Lincoln Hall lads swept on to place well up in the baseball series, and to lead the way home (for the first time in a good many years) in the crew races.

In the swimming meet the C.E.'s took first in every event and run up a very impressive score. Hoyt and Bovay placed one-two in the dashes, while Dales and Zwenig were taking firsts in the backstroke and breaststroke respectively. Then the relay team fluttered to an easy first, using Dales, Booth, Gillespie, and Bovay.

The first game of baseball saw a strong C.E. club on the field, favored along with the Hotel nine to lead the way to a championship. However the later games saw a lessening of interest, and only the lack of players lost the pennant to "Hollister's boys". Hoyos played behind the cage; Mills and Bovay both tossed the ball consistently and well; Wicker was perhaps the best first sacker in the league, as well as a dangerous man at bat; Reppert and Serby, both sluggers, were at the second and third bases; and Luippold, Soman, and Galpin patroled the outfield.

The crew turned in a good performance by being the



NOTES

first legitimate crew across the finish line, and finally showing the way to their old rivals, the Foresters. Mills was at coxswain and Christensen at stroke, Senesi, O'Kain, Varlan, Van Nest, Wandling, Harris, and Tobey rowed in the one to seven positions in the order named. This race was one of the fastest and most interesting that we have seen in years and a great deal of credit should be given to the men for their intensive training and work.

Harry E. Bovay jr. was Athletic Manager for the school during this time.

* * * *

ME AND AE GRADS FIND EMPLOYMENT

We are pleased to report that the ME and AE graduates of the class of 1935 have been unusually successful in securing jobs, according to the latest statistics released by the College. The following tabulation tells the story:

Emploment Statistics for M.E. & A.E. Students Graduating June 1935 *as of Oct.* 1, 1935

MECHANICAL ENGINEERS (50)		
Employed	40	80%
Graduate Work	3	6%
Unemployed	7	14%
ADMINISTRATIVE ENGINEERS (40)		
Employed	32	80%
Graduate Work	3	7.5%
Unemployed	5	12.5%

* * * *

DELTA CLUB

The Fall initiation of the Delta Club was held Saturday, October 26 at the time worn and justly honored Kappa Bete grounds far above Cayuga's waters. Seven men of the Class '36 were brought with every solemnity into the great brotherhood by a ceremony which began after a proper warming up interval with a touchfootball game between the members and initiates. The members being more hardened than the initiates and having the skilled assistance of Bill Mater were able to outscore them by 78 points. The intense play and the heat of the day created great thirst which in due time was properly quenched. There followed a great and mighty feast so great in fact that "Chief" Lincoln expressed fear that wifely wrath would be forthcoming at dinner that night. The meeting was adjourned at 5:30 P. M.

* * * *

A.S.C.E. HOLDS FIRST MEETING OF TERM

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

The Cornell Student Chapter of the American Society of Civil Engineers held its first meeting of the year on October 15, in 2 West Sibley. President Glasser presided.

The meeting was opened with a report on C. E. Athletics given by Harry E. Bovay, retiring manager. A summary of his report will be found elsewhere in this issue. John McManus, President of Chi Epsilon then gave a brief outline of the purposes of that Society and of its administration of the new honor system. The Chi Epsilon prize annually awarded to the freshman Civil Engineer who has had the highest average in his class, was presented to Ray Ali '38. The prize consisted of a copy of O'Rourke's Engineering Handbook.

Following the presentation of the award, Professor F. A. Barnes showed several reels of a movie depicting various excavating methods and different types of excavating machinery.

The highlight of the meeting was an address by Professor S. C. Hollister, Director of the School of Civil Engineering, on "Civil Engineering—Your Chosen Profession." He outlined briefly the history of the development of Civil Engineering, and discussed the discoveries which have made possible the rapid advancement during the past two centuries. Professor Hollister emphasized the necessity for a thorough understanding of past accomplishments in the profession, and for a development of professional pride among present day engineers.

After adjournment, the seventy-five students and faculty members present retired to the basement of Sibley Dome for cider and doughnuts as a pre-Hallowe'en celebration.

ALUMNI NOTES

Just as another example of the versatility of the C.E. men of Cornell we bring to notice that Alan F. Williams C.E. '15, a division engineer of the Western Pacific Railroad has served the Rocky Mountain Conference, the Pacific Coast Conference, and the Far West Conference in the capacity of football official. As an undergrad Mr. Williams was quite active on the athletic field being on both the football and the soccer teams. Mr. Williams can be reached by mail addressed to P. O. Box 529, Elko, Nevada.

A. Haslup Forman M.E. '31 has reported a change in address. The present and future address at which he may be found is 18 West 25th St. Baltimore, Md.

Eugene F. Murphy '35 M.E. is an assistant in mechanical engineering at Syracuse University where he is doing graduate work in the field of heating and ventilating. Murphy now lives at 725 Allen Street, Syracuse.

It really does break our hearts to see the ranks of the single engineers fall off as one or the other stalwarts wall under the spell, but it does make us feel quite proud of those who have gone before us, for it is not the unsuccessful who take up the responsibility of marriage and the ranks of the married are ever increasing. At the head of this months list we take pleasure in placing Leslie I. Ferguson '27 M.E. Mr. Ferguson was recently married to Miss Carolyn Jones of Montclair, N. J. The best man at the wedding was Garwood Ferguson M.E. '33.

Another recent addition is Richard S. Lane who is an engineer for the Ross Heater and Manufacturing Co. of Buffalo, N. Y. He was recently married to Caroline Cole of Bradford, Vt. The Lanes may be congratulated at 27 East Morris Avenue, Buffalo, N. Y.

Enloe McClain '28 M.E. is sales engineer with the Electrolux refrigerator sales division of Servel Inc. Evansville, Ill. He gives his mailing address as 206 Craighead, Nashville, Tenn.

Paul Kelleter and Roy A. Bass of the class of '34 are in the employ of the Ross Heater and Manufacturing Co. of Buffalo, N. Y.

Haywood G. Dewey '35 C.E. is residing at 2511 East Avenue, Agron, Ohio.

'78 BME—Robert H. Treman and Mrs. Treman greeted nine members of the Nonagenarians Club who, on Sept. 21, were entertained by Treman King and Co. which is commemorating its ninety-first anniversary this month.

'92 ME—Edgar A. Carolan and Mrs. Carolan were among the many who stopped in Biarritz, famous French resort for the late summer.

'27—Arthur D. Shaw lives at 92-27 215th Place, Queens Village, L. I. He is engineer in charge for Srlandsen and Crowell, civil engineering and surveying of Jamaica, New York.

'27—Franklin E. Millan, sales manager for the Elliot Co., has his office at 1835 Dime Bank Building, Detroit, Mich.

'32 ME—Mearick Funkhouser is employed in the engineering laboratory of Delco Products Corp. His address is 300 Lonsdale Ave., Detroit, Mich.

'03—Lucius Hulburd is superintendent of the mid-Hudson highway bridge at Poughkeepsie. His office is at 103 Union Street.

'04 ME—Harry S. Brown was recently elected president of the Foster-Wheeler Corporation, New York City.

'07 ME—Franklin D. Hooper is now with the Barber-Greene Co., 601 West Twenty-sixth St., New York City.

'24—Harry W. Eustance, Ithaca's city engineer is secretary of the newly formed Flood Council of Central and Southern New York.

'35 ME—J. Rogers Hamilton, John W. Todd Jr., A. Scott MacQueen are working for the Carnegie Stell Co. at Homestead, Pa. Their respective addresses are 25 N. Howard Street, Bellevue, Pa., 6941 Perrysville Ave., Ben Avon, Pittsburgh, Pa., 610 Twelfth Ave., Homestead, Pa.

'11 ME—Mortimer Frankel is vice-president and general manager of the Fairbanks-Morse Home Appliances Inc. His address is 430 South Green Street, Chicago,Ill.

'11 ME—Stanley B. Kent, attorney in the patent dept. of the Bell Telephone aboratories reports that his son Louis has matriculated in the Med. College.

'12 ME—G. Porter Brockway is purchasing manager for the American Optical Co., Southbridge, Mass.

'27, '28 EE—G. Norman Scott is sales representative in New York and Westchester County for Estabrook and Company, investment bankers. He lives at 66 Bowman Ave., Port Chester.

'30—T. Brian Parsons is development engineer with The Aluminum Co. He lives at 330 Kensington Drive, New Kensington, Pa.

'28 EE—Norman A. Miller is electrical engineer for the sanitary district of Chicago, Ill. He lives at 5419 University Ave.

'29—Pierre Purcell is employed by the government as inspector of construction of CCC camps. He lives at Quaker Bridge.

'35—A. Roy Longenecker former editor in chief of the Sibley Journal of Engineering is in the engineering con-

struction department of the New York Telephone Co. His address is 8405 Eighty-Ninth Street, Woodhaven, L. I.

'26 ME—A. N. "Red" Slocum, who since graduation has been with the Exide Storage Battery Company, the first of this year took an important sales position with the Firestone Tire Company in the eastern area. He lives in Pleasantville, N. Y.

'26 ME—T. S. "Chad" Chadeayne recently resigned from a position in the commercial department of the New York Edison Company to take a job as Assistant Sales Manager of the Bradley & Hubbard Company, manufacturers of lamps in Meriden, Conn. Mr. Chadeayne has spent the few months that he has been in his new position, travelling over most every state in the country.

'01 CE—C. B. Brown is now Chief Engineer of the Canadian National Railway in Montreal. His address is 360 McGill Street, Montreal, Quebec.

'06 ME—Edward W. Campion is now Vice President & General Manager of the Bonney-Floyd Company, manufacturers of steel castings at Columbus, Ohio, having severed his connection with the Buckeye Steel Castings Company. His new address is care of that company at Columbus, Ohio.

'23 CE—Dionisi Suarez Jr. writes that he is now Assistant Chief Engineer of Public Works in the Province of Pinar del Rio, Cuba, and would especially like to hear from some of his classmates. His address is Sabalo, Pinar del Rio, Cuba.

'00 ME—H. T. Coates is Purchasing Agent of the Dairymen's League, living at Montclair, N. J., with his headquarters at 11 West 42nd Street, New York, N. Y. He is extremely active in other organizations, has recently been reelected Director in the National Association of Purchasing Agents where he has been active for a great many years working on various committees, and is Chairman of the Seaboard Region of the Standard Coal Committee. He is also on the Committee on Clean Coal of the American Standards Association and still has time to devote considerable activity to committees in the American Society of Mechanical Engineers, not counting the various articles and addresses which he has written and made for purchasing agents on the subject of coal buying.

'08 ME—Roy C. Folger is General Engineer for the Electric Smelting & Aluminum Company at Cleveland, Ohio. His home address is 10525 Carnegie Avenue, Cleveland.

'16 ME—Otto de Lorenzi, has recently been promoted to Assistant General Sales Manager of Combustion Engineering Company, Inc., 200 Madison Avenue, New York. Mr. de Lorenzi has been with this Company since 1916 and previous to his promotion was on the technical staff of the proposition unit.

'13 CE—Wallace D. DuPre is in the wholesale automotive supplies and shop equipment business at 138-140 West Main Street, Spartanburg, South Carolina.

'88—Alfred H. Eldredge says he is retired but still keenly interested in Cornell matters and engineering problems. He is living at his home at 74 Laurel Street, Melrose, Mass.

'27 Arch.—While Dodd McHugh is an architect, his work has thrown him much in contact with engineers and he is much interested in "The Cornell Engineer" and has applied for a subscription to "The Cornell Engineer" and for membership in the Cornell Society of Engineers as a means of keeping in touch with things engineering-wise at Cornell. It is with great interest, therefore, that we welcome him to membership in our Society since we want and need members who are that interested in engineering activities at Cornell. Mr. McHugh is now Assistant Director of the Mayor's Committee on City Planning of the City of New York.

'25 CE—Richard I. Land who lives at Mamaroneck Knolls, New York, was recently elected President of the University Club of Mamaroneck at the Board of Governors' meeting on August 1st. He lives at 3 Langdon Lane, Mamaroneck, N. Y.

'10 CE—Ed S. Crosby is now Vice President & General Manager of Johns-Manville International Corporation and devotes a considerable amount of his time to travelling throughout the world. He and two other Cornellians, chemical engineers, Arthur S. Elsenbast B. Chem. '12 and William H. Van Arnam B. Chem. '17, came with Johns-Manville when the Celite Corporation was acquired by that company.

'33 CE—Raymond R. Heddin was married in Wilkes-Barre, Pa., to Dorothy Turner. He is associated with the W. L. Crow Construction Co. of New York City.

'34 ME—Irving Taylor is student engineer for the General Electric Co. of Schenectady. He lives at 1279 Lowell Road.

'34 CE—James A. Allen received his commission at the United States Army Aviation School, Kelley Field, Texas. He is now stationed at Langley Field.

'01 ME—The Carrier Engineering Corporation, Newark, New Jersey, of which Willis H. Carrier is chairman of the board, is installing the worlds largest air conditioning plant in Robinson Deep, a rich gold mine at Witwatersrand, South Africa. The contract calling for a $500,000 expenditure, will supply the mine, 8,500 feet deep, with 400,000 cubic feet of air at the velocity of 2,000 ft. a second at 35 degrees Fahrenheit.

Benjamin F. Bardon '13 M.E. was recently placed in the position of assistant superintendent of the Boston division of the New York, New Haven, and Hartford Railford. Mr. Bardon now resides at 27 Upland Road, Quincy, Mass

'35 AE—Robert E. Pfief is taking an engineering test course at the General Electric Company. His address is 27 Snowden Avenue, Schenectady.

'33 ME—Henry M. Devereux, who, with a group of other Cornellians cruised in the ketch "Calsark" from Ithaca, New York to the Ionian Ithaca of Ulyssean Legend a few years ago, and who was a member of Seal and Serpent Fraternity while here, built this summer a new forty foot cutter of his own design. In her he has successfully raced in the vicinity of Long Island Sound. He is a practicing naval architect. Devereux's address is 295 City Island Ave., City Island.

'35 EE—V. Larry Dzwonczyk works in the development laboratory of the Diehl Manufacturing Company, Elizabeth, N. J. His address is 438 East Seventieth St., New York City.

'35 EE; '35 EE; '34 EE—Robert Weeks, Earl Elmer, Jr., and Robert F. Miller are employed in the radio department of the General Electric Company at Bridgeport, Conn.

'35 ME—Robert H. Richings is enrolled in a two-year graduate course in mechanical engineering at the Massachusetts Institute of Technology in Cambridge, Mass. During the summer he was employed by the General Electric Company in Lynn, Mass., and writes the ALUMNI NEWS that he will resume work for that corporation next spring. Hiss address is 529 Beacon Street, Boston, Mass. After February 1, 1936, it will be 554 Western Avenue, Lynn, Mass.

Cornell Engineers

Cornell may well be proud of John Edwin Armstrong '08 CE. Mr. Armstrong who has just been awarded the plaque of the American Railway Engineering Association in token of his services as president of the society, is another example of the type of men Cornell has produced in the past and, we hope, will produce in the future.

Mr. Armstrong graduated from Cornell in '08 and was associated with the Penn. Lines west of Pittsburgh in the capacity of Assistant in the Engineering Corps in charge of construction and maintainance of way. In '12 he went to the Canadian Pacific Railway as Assistant Engineer in charge of yard and terminal design and as a general head office engineer. Throughout his career Mr. Armstrong has taken responsibility as it came and has shown himself capable of meeting each problem with a practical solution no matter how difficult the situation.

No better method can be taken to express the value of this man than the words of the representative of the Association in the presentation of the plaque. "This Association, Mr. President, has honored you with many positions in its organization. You have served its committies splendidly. I have been instructed, sir, many times by you as chairman of a committee. I have been picked upon on various occasions, and on this occasion I am picking on you.

"We have watched your progress on the Board of this Association. The Association, sir, honored you with its Presidency, and I believe that I voice the sentiment of every man in this room and every man in the organization that has had the priviledge of attending the convention this year, when I say to you, sir, that the Association has been honored in having you as its presiding officer.

"I have here a very beautiful plaque. It is in the form of a shield, the emblem of the Canadian Pacific Railway. It bears the following inscription.

" 'The American Railway Engineering Association records its grateful appreciation to JOHN EDWIN ARMSTRONG for notable services renered as President in 1934-35. He has contributed generously of his time and talent to promote the welfare and interests of the American ailway Engineering Association. Under his progressive leadership the affairs of the Association have been wisely and ably administered and its record of achievement maintained on the high plane of past years. This is tribute of our affection and regard.' "

Mr. Armstrong lives at 4060 Marlow Avenue, Montreal, Canada.

Mercury Boilers

(*Continued from page thirty-one*)

calorized or coated with aluminum to prevent oxidation at the high operating temperatures.

In both of the above cases heat from burning fuel in the furnace is transeferred to the mercury in the up-take pipes of the U-tubes. In the porcupine tube the heat absorption is by radiation as well as convection from the hot flue gases passing between the tubes. The wall tube absorbs its heat entirely by radiation from the flame and hotter parts in the furnace. The heat absorption by the mercury produces boiling and vaporizing of some of the mercury in the up-takes. A circulation of liquid mercury is, thereby, set up in the U-tubes. The up-take portion of the tubes are partially filled with vapor bubbles, while the down-pipes are solid liquid. This difference in density results in a pumping action which produces and maintains a circulation as long as heat is applied. By means of baffles in the boiler drum, the liquid is separated from the vapor and recirculated through the tubes. The ratio of total liquid thus circulated to vapor formed is about thirty to one by weight. The vapor is conducted by means of vapor piping through a throttle and governor valve to the mercury turbine. The valves are hydraulically operated and opened wide after the turbine is synchronized on the line. This permits the mercury equipment, which is more efficient than the steam turbine, to take the maximum demand as a base load unit. Variations in the mercury load are produced by changing the boiler pressure.

The turbine is a comparatively slow speed machine and of a simple impulse type. Only a few stages are needed as the available energy for the pressure range is small. This requires a large vapor flow, about a hundred pounds for each kilowatt hour produced by the generator attached to the turbine. At the exhaust of the turbine the mercury is still hot enough to boil water and make steam at pressures which are in common use. So, instead of circulating cooling water through tubes in the mercury condenser, as is done in an ordinary steam turbine condenser, a level of boiler feed water is maintained instead in the drum on top of the condenser. This boiler feed water also fills the dead ended tubes hanging in the mercury condensing space from the drum. The heat of condensation of the mercury is given up to this slightly cooler water, (approximately 30.°F. less due to the heat gradient across the tubes). The water in the tube boils and makes steam which leaves the drum or steam dome above the water level through a dry pipe. The condenser-boiler, as this apparatus is called, is really a heat exchanger. Additional energy is given to this stream by superheating it in the flue gases beyond the mercury boiler. It is then used in steam turbines where its available energy is transformed into electrical energy. On leaving the exhaust of the steam turbine the steam enters a condenser where the heat of condensation is picked up by circulating cooling water and carried out to the local river or lake. This is the inefficient end of the cycle and improvements over the limits fixed by nature are questionable. The water condensate is pumped from the hot well of the steam condenser, usually through one or more feed water heaters, to the condenser-boiler to again be made into steam. The condensed mercury, as a liquid, leaves the bottom of its condenser and runs through a filter or sump, where it is cleaned before re-entering the boiler. Then it is pumped or runs by gravity, if the condensers are situated high enough above the mercury boiler, through a mercury liquid heater in the flue gases leaving the mercury boiler tubes. Sufficient heat is picked up by convection from the flue gases to preheat the mercury liquid to the boiler saturation temperature before it enters the boiler. It is, therefore, ready to be immediately vaporized again and pass through the above cycle.

The mercury level in the boiler drum can be seen by the operator. This is done, not by seeing it through a glass tube, but by means of a magnetic solenoid arrangement which indicates on a gauge the position of a three pound solid steel float which bobs up and down on the surface of the mercury as a cord does on water.

The mercury system is, however, a closed circulating system. All its tubes, connections and piping and even the boiler drums and the turbine and condenser shells are put together or fabricated by the electric arc or acetylene welding. No leaks can be tolerated. To insure tightness a double operating pressure hydrostatic or air test is put on the entire system before it is put in service.

As a precaution against excessive vapor pressure in the mercury boiler two safety valves are connected to the main vapor pipe before it enters the turbine. Each is capable of taking full flow and the exhaust of these valves by-passes the turbine and enters the mercury condenser separately. The heat of any vapor coming through these safety valves is immediately picked up by the circulating boiler feed water in the condenser tubes and forms steam. Excessive steam pressure in the condenser-boiler drum is vented to the atmosphere by means of steam safety valves attached to the drum. The stems of the mercury safety valves, as well as those on the throttle and goevrnor valve, are prevented from leaking by the use of steel accordions. These are welded to the stem and casing of the valve and expand or contract as the valves open and close.

The condenser or vacuum exhaust of the mercury turbine is protected against high pressure by means of a

safety diaphragm. This will rupture at a few pounds pressure into a duct connected to the stack. Air leakage into the vacuum mercury condenser along the turbine shaft is prevented by means of a water seal. This seal is formed between a stationary textolite ring and a smooth steel runner which rotates with the turbine shaft.

History

The above description covers the general design and operating characteristics of the mercury boiler equipments in operation today. The specific installations and their applications with a few figures are as follows:—

In 1927 a mercury boiler was installed in the South Meadow Generating Station of the Hartford Electric Light Company at Hartford, Conn. It consisted of seven horizontal drums hung side by side and carrying a total of 3080 porcupine type mercury boiler tubes, suspended above the firebox. The boiler operates at 70. lbs./sq. in. G. mercury pressure and a saturated temperature of 884.°F. At full load about one million pounds of mercury vapor is produced which passes through a single flow, five-stage, 720 R.P.M. overhung turbine. This drives a generator, producing 10,000 KW. In the two condenser-boilers on the exhaust of the turbine, the condensing mercury at a 28.5″ vacuum generates steam in the condensing tubes at 275. lbs. G. pressure—414°F. The amount of steam produced is 129,000 lbs./hr., which is superheated in the flue gases to 680.°F. and used in steam turbines. During 1934, this unit produced 50,013,000 Kw hrs. from the mercury turbine and steam equivalent to 69,100,000 Kw. Hrs. This represents a load factor of 57.2%.

In 1932 a mercury boiler was built and installed at the Kearny Generating Station of the Public Service Electric and Gas Company at Kearny, New Jersey. It also consisted of seven horizontal drums, carrying a total of only 2,640 porcupine type boiler tubes.

The upper half of the furnace walls, however, were made of 172 sections of mercury wall type tubes supported from both ends of the middle drums and the sides of the outside drums. The lower half of the furnace walls were covered with water wall tubes. This unit operates at 140 lbs./sq. in. G. mercury pressure and a saturated temperature of 975.°F. At full load, 2,100,000 pounds of mercury vapor is produced by oil firing in the furnace. This passes through a double-flow five stage—900 R.P.M. mercury turbine dring a generator which will produce 20,000 KW. at this flow. Two condenser-boilers, one on each side of the turbine, condense the mercury at a 28.″ vacuum and generate steam at 365. lbs. G. pressure. The total steam produced from the unit is 330,000 lbs./hr., of which 80,000 lbs. is produced in the water wall by direct heat pick-up from the fuel. It is all superheated to 750.°F. in the flue gases and used in steam turbines. Based on a 10. pound steam water rate the mercury unit in this station will produce

53,000 KW. of electrical energy, combined mercury and steam, at a rate of 9,600 B.t.u. per kilowatt.

In 1933, a mercury boiler was built and installed in a new outdoor steam station in the General Electric Company's plant at Schenectady, N. Y. The boiler, turbine and condensers are identical in size with those installed at Kearny, N. J., and operate at nearly the same conditions. Pulverized coal firing is used and this is the first mercury plant to use pumps to force the mercury liquid from the condensers back into the boiler. It is different than both the above two stations in that it was installed to produce steam for heating and process work in the factory rather than to generate electrical energy. The load carried on the mercury turbine is, thereby, fixed by the steam demand. The kilowatts produced are a by-product formed in the process of making steam. For every thousand pounds of steam produced in this plant at 200. lbs. G. pressure, there is a by-produce of 80. kilowatt hours furnished by the mercury turbine. In future designs the water wall with its direct heat pick-up from the fire in the furnace will be eliminated. The result in such a station would be a 100. kilowatt-hours of by-product power for each thousand pounds of steam used. This is the most economical way of producing power and steam from fuel at the present time. There are numerous cases in industrial as well as city and even college steam heating plants where it can and will be applied.

Conclusion

In closing, mercury is quite an ancient metal when compared with the common ones we know about today. It was originally called quicksilver and was known at least four centuries before the Christian Era. From history we learn that the Greeks and Phoenicians procured cinnabar, the commonest of the mercury ores, from Almaden in Spain. These same mines are still being worked today by convict labor and are considered the richest in the world. Other deposits in large and small quantities have been found in Austria, Peru, numerous places in the United States, particularly California, Canada and Australia. Due to the comparatively small and unstable demand with its fluctuating price change only the richest mines are worked and with very few refinements from the old methods of distillation used by the Greeks. With the establishment of a large basic demand for mercury, capital and industry will undoubtedly step into the mining field with more efficient methods and equipment. The result will be that even the large areas of poor grade deposits will be worked on a paying basis.

CAMP CORNELL

(*Continued from page thirty-four*)

programs so that each one received an equal share of work in Triangulation, Precise Levels, Base Line Measurement, Topographic Levels, Hydrography, and Railroads. This years work in Triangulation was the culmination of an eight year plan. In 1928, the survey was started at a station called Newfield which was part of the New York State Survey. An azimuth was taken from the Library Tower on our own campus, and stations Moot and Amy were established. During the next six years, the system was extended around Cayuta Lake towards the south, along the West shore, and then up to the North, where, in 1934, station Leon was established. This year's work proceeded from Leon back to Moot and Amy,—effecting closure of the traverse. In a distance of from fifteen to twenty kilometers, the error of closure was .4 of a meter—or 16 inches— well within the limits of second order work. ("Fair" . . . says Professor Boothroyd)

Precise Levels

Another purposeful activity was carried on under Precise Levels,—though actually only a small part of a long enduring plan. In the dark past of the Cornell Summer Surveys, our engineers proceeded from Lincoln Hall and ran a line of precise levels around Cayuga Lake, starting on the South at Ithaca, going up around the West through Jacksonville, through the village of Cayuga on the North, and then down on the East back to Ithaca. It was later realized that the United States Coast and Geodetic Survey had run lines of levels through the very southerly and northerly parts of the state of New York. The idea was conceived of connecting in the Summer Camp's work with that of the offical government survey. It was found, however, that the work done by our boys was not quite accurate enough to be acceptable. When camp was later established at Cayuta Lake, a possibility for a check survey presented itself. Several surveys were run from Horseheads up through camp and over to Swartwood. Levels were run along the eastern and western sides of Cayuta Lake. This year the line of levels was picked up at the northwestern corner of the lake and extended in the direction of Jacksonville. It is hoped that this will be accomplished in the near future and the larger errors will be discovered.

Hydrography was indulged in to a lesser degree, but it was still a favorite with most of the boys, as it afforded an opportunity for an excellent sun-bath as well as the practical and informational instruction under the guidance of Professor Lawrence. It seems we do recall some fine points on fishings and the care of animals. And how great was our consternation at finding, after we had rowed half way around the lake in "Old Ironsides", that we we had forgotten the sounding pole.

Railroads

During the last two weeks, our administrative ranks were enhanced by the arrival of Professor Thatcher and Mr. Spry. Immediately they arrived, efforts were con-

centrated on Railroads, while the finishing touches were being put on all other activities. In this work, which is a real part of the course in Railroads taken usually in the Junior Year, two lines were run out for an imaginary railroad on Foot's Hill, overlooking Texas Hollow. Each day found different groups assigned to special duties in laying out the route, and before long there developed a feeling of keen competition, heightened by the statistical reports of the day before as quoted by Professor Thatcher In each case a preliminary line of specified gradient was run out by a transit party ,followed by several parties of levelers, and they in turn by topographers. This information was then plotted up by Professor Thatcher, and the route of the railroad definitely determined. This was then laid out carefully, staking out all curves with accurary and speed, after which cross-sectioning was run over the line.

Ambitious parties found their industry rewarded with some additional training in plane table, mapping small areas nearby,—a most interesting experience. But the greatest values derived lay along the lines of experience in assuming important responsiblities, and also the most excellent opportunity of getting to know one's class-mates and over-seers as well. The experiences of the individual members of that group will undoubtedly remain clearly impressed upon their recollections of college days, and it wouldn't surprise this humble personage to find that in the bull sessions of the future when old grads of the class of 1937 get together, there will still be some question as to whether or not any real deer were seen in the neighborhood of camp, or Harlow's ramblings about sheep were on the up and up, or whether the self-named Potential Surveyors of New York Area were really so potential.

Conclusion

Camp closed with the usual spirit of revelry, but as far as we were able to ascertain, not as ostentatiously as the preceding year. However, there have been reports of big doings in the vicinity of Fountainbleau, a spot of great favor amongst Cornell Engineering students since 1928, and of various and sundry pranks about camp. It was with some relief (we imagine) that Wandling threw down that last plate of scrambled eggs in front of Bovay on that last Saturday morning, and Art Glasser pulled out of camp with the last load of baggage.—But we're willing to wager everyone had a great time and considered their time well spent.

Perhaps we have created some illusions or false fears in the mind of some of our readers and future campers, but we do heartily recommend camp as a most profitable way of acquiring valuable technical and practical surveying experience, and spending a very pleasant five weeks of the summer months.

G-E *Campus News*

PATENTED LILIES

WHEN left to their own devices, regal lilies get themselves all spattered by yellow pollen. It's a messy business—like a man in a white linen suit spilling egg yolk all over his vest. So the florists have to watch these blooms carefully and pluck the pollen-laden anthers before they have a chance to burst.

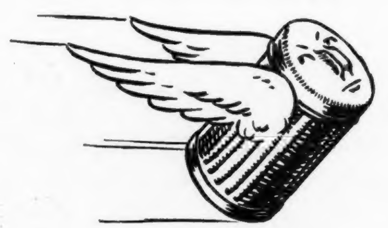
In the General Electric Research Laboratory, C. N. Moore, Dartmouth, '05, has for years been investigating the biological effects of x-rays. Among other things, he treated 75 regal-lily bulbs with varying amounts of x-rays. Untreated bulbs of the same batch grew up normally. Among the treated bulbs, there were some monstrosities and some apparently normal flowering plants. The results were different the next season. The progeny of two of the bulbs that had received 30-second doses of x-rays produced flowers with nonshedding anthers. Each year the new strain has continued true, and the nonshedding property is considered a fixed characteristic. The Roentgen lily, as it is called, is now established as a variety of regal lily.

AWARD FOR COURAGE

IN the face of a difficult and serious competitive situation, the entire personnel of the Tennessee Electric Power Company, of Chattanooga, under the leadership of its president, proceeded to develop one of the most unique sales programs ever carried out by an American public utility. Every individual in the organization, regardless of position, became a salesman for the company's kilowatt output. One of the bases of this program was a substantial reduction of rates. The result was a great increase in electric-appliance sales, and a 26-per-cent increase in residential consumption.

The company co-operated in the sale of appliances with dealers, with the TVA, and with the EHFA. Its industrial department has been at least partly responsible for the location of 29 additional industries, employing 1995 workers, in the territory it serves.

For these accomplishments, the Tennessee Electric Power Company received the annual award for 1934 of the Charles A. Coffin Foundation, which was established by General Electric in 1922 in honor of its first president. The award comprises the Charles A. Coffin gold medal, a certificate, and a check for $1000 to be deposited in the treasury of the utility's employee welfare association.



GOOD-BYE, GARBAGE CAN

THE oil furnace has placed the skids under the ash can. And now, a new device developed in a General Electric laboratory promises to do away with the garbage can. This new device, operated by a ¼-horsepower electric motor, grinds the waste food. Grinding knives made of Carboloy—a metal next to diamond in hardness—shred all types of waste food, including bones and other hard substance. The only things it cannot handle are glass and tin cans. Reduced to a fine pulp, this waste is flushed by water into the sewer.

The grinder is simple to install and operate. The entire unit weighs about 75 pounds, and may be installed under any style of sink as a part of the outlet plumbing. The hopper inlet is covered by a perforated cap, flush with the sink bottom. When the hopper is full, all one has to do is turn a handle which projects conveniently from beneath the sink. This closes the hopper and starts the grinder. In the average family, the grinder will operate not more than five minutes a day, and its average cost of operation per month will be about one-half that required for operating an electric clock.

96-179DH

GENERAL ELECTRIC